HY313X EVA Test Tool

User Manual

Table of Contents

1. Description of ENOB and Noise Free

RMS Noise that generated from Sigma Delta ADC is the minimum voltage value of distinguishable sampling signal. Hence, ENOB (Effective Number of Bits) is calculated by RMS Noise and Full Scale Range ratio. However, RMS Noise must be calculated by many average times. Insufficient sampling times can only represent RMS Noise for a specific period of time instead of the RMS Noise of the entire ADC operation. Therefore, RMS Noise operation times cannot be less than 1024 times.

However, Noise Free Bit represents that ADC output value count is not rolling. Noise Free Bits are stable ADC output performance. Bit operation is defined as Peak-to-Peak Noise and Full Scale Range ratio.

RMS Noise Equation:

$$\text{平均Count} \rightarrow \text{Average} = \frac{\sum_{k=1}^{n} \text{ADC}[k]}{n} \quad (1)$$

$$\text{RMS Noise} = \frac{V_{RFE} \times \sqrt{\dfrac{\sum_{k=1}^{n} \left(\text{ADC}[k] - \text{Average}\right)^2}{n}}}{2^{\text{Scale}}} \quad (2)$$

In the above equation, n represents total sampling number of ADC and Scale represents ADC total output bits. ENOB and Noise Free Bits can be gained by taking Equation 1 and Equation 2 to the following equation:

$$\text{ENOB} = Log_2\left(\frac{\text{FSR}}{\text{RMS Noise}}\right) = \frac{In\left(\dfrac{\text{FSR}}{\text{RMS Noise}}\right)}{In(2)} \quad (3)$$

$$\text{Noise Free Bits} = Log_2\left(\frac{\text{FSR}}{\text{Peak-to-Peak Noise}}\right) = \frac{In\left(\dfrac{\text{FSR}}{\text{Peak-to-Peak Noise}}\right)}{In(2)} \quad (4)$$

Equation of Peak-to-Peak Noise:

$$\text{Peak-to-Peak Noise} = \frac{V_{REF} \times \left(\text{ADC}_{Max} - \text{ADC}_{Min}\right)}{2^{\text{Scale}}} \quad (5)$$

2. Hardware/Software Installation

2.1 Minimum System Requirements

1. Hardware Requirements:

IBM AT/ATX PC PENTIUM® or any above compatible type

Memory size > 32MB（>256MB is recommended）

Resolution > VGA 1024×768, 256-color display

Hard discs space > 10MB

USB port

2. Operation System

Windows™ 98SE

Windows™ 2000

Windows™ XP

Windows™ Vista

Windows™ 7

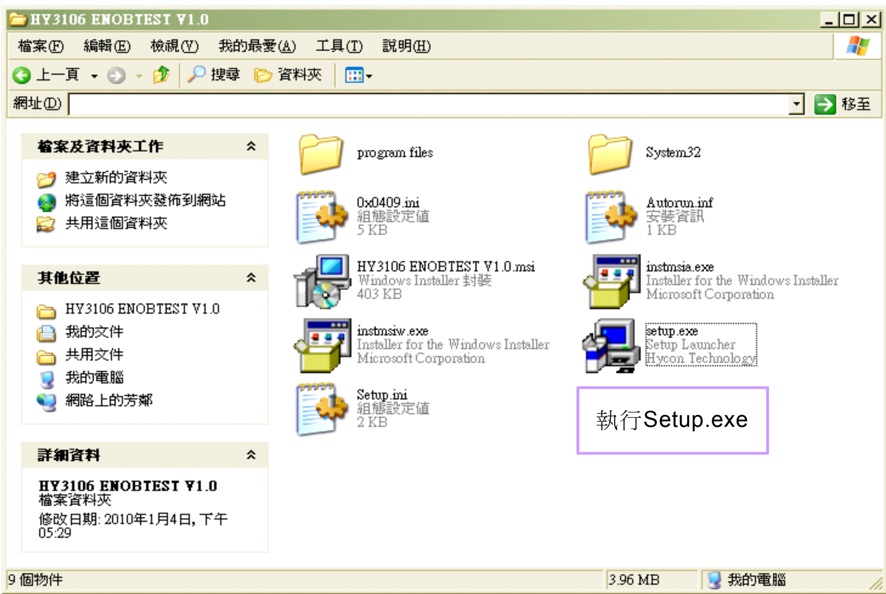
Not supportive for 64 bit window, *nix and OSX operation system. Menu could be unreadable code when operating in non-traditional Chinese operation system.

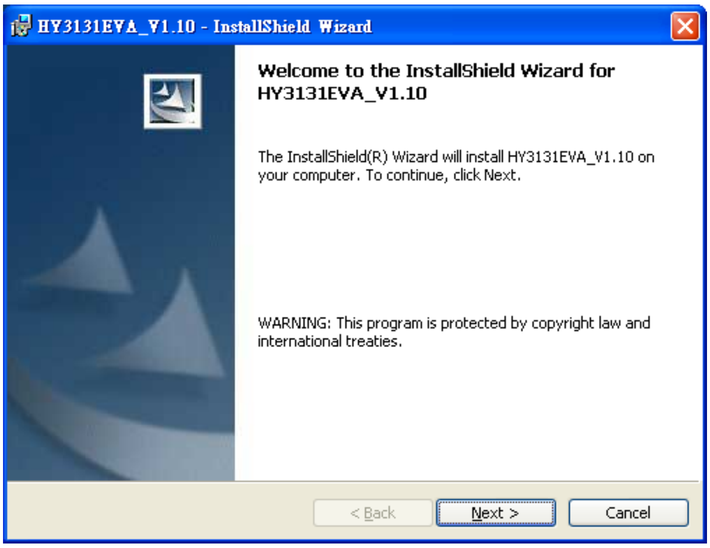
2.2 Installation and Removal

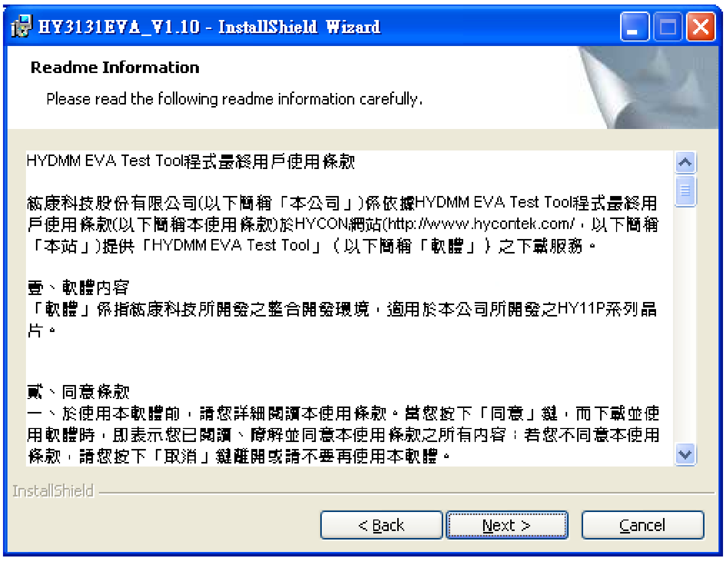
1. Software Installation

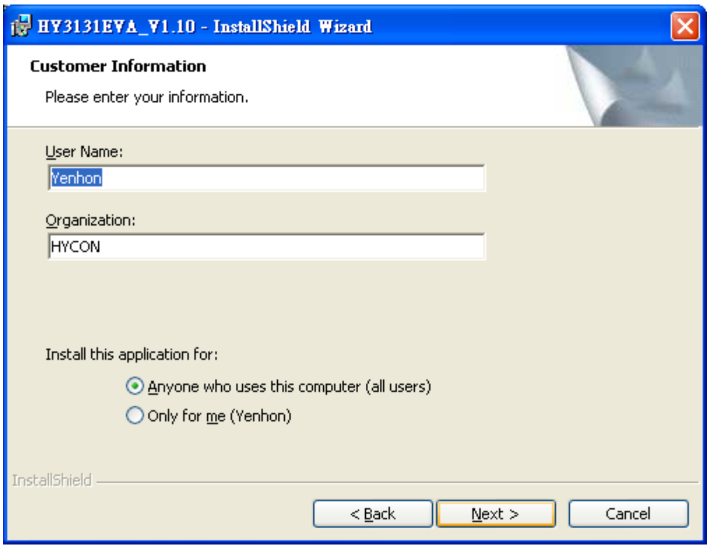
For certain operation system, it requires Administrator identity to install software to the computer.

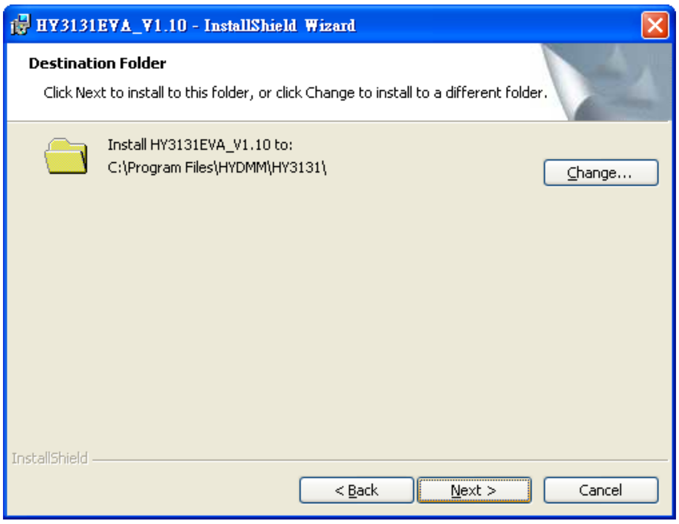
- Look for Setup.exe and execute it from CD-ROM menu or unzip file. Proceeding the installation procedures as frame indicates. As shown in below dialog window.



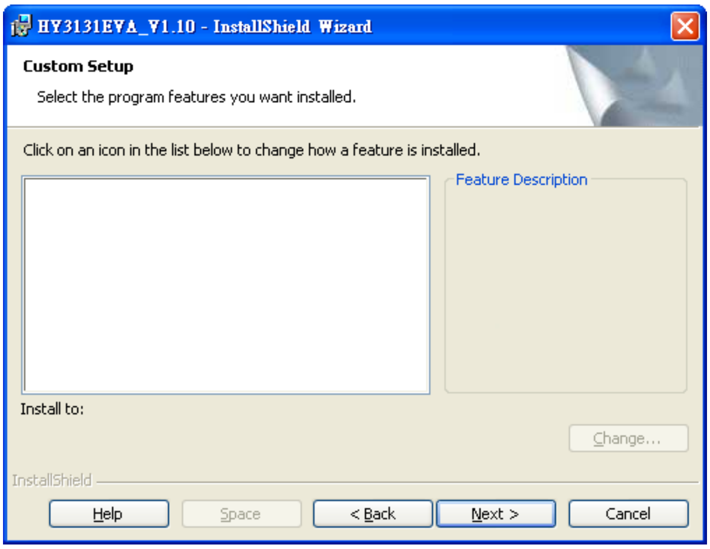

HY3131EVA_V1.10 - InstallShield Wizard
Welcome to the InstallShield Wizard for HY3131EVA_V1.10
The InstallShield(R) Wizard will install HY3131EVA_V1.10 on your computer. To continue, click Next.
WARNING: This program is protected by copyright law and international treaties.
< Back
Next >
Cancel

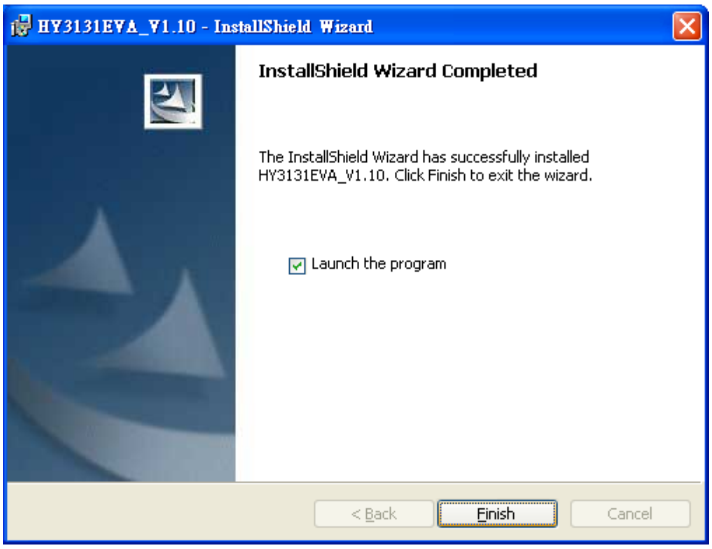

HY3131EVA_V1.10 - InstallShield Wizard
Readme Information
Please read the following readme information carefully.
HYDMM EVA Test Tool程式最終用戶使用條款
紘康科技股份有限公司(以下簡稱「本公司」)係依據HYDMM EVA Test Tool程式最終用戶使用條款(以下簡稱本使用條款)於HYCON網站(http://www.hycontek.com/，以下簡稱「本站」)提供「HYDMM EVA Test Tool」（以下簡稱「軟體」）之下載服務。
壹、軟體內容
「軟體」係指紘康科技所開發之整合開發環境，適用於本公司所開發之HY11P系列晶片。
貳、同意條款
一、於使用本軟體前，請您詳細閱讀本使用條款。當您按下「同意」鍵，而下載並使用軟體時，即表示您已閱讀、瞭解並同意本使用條款之所有內容；若您不同意本使用條款，請您按下「取消」鍵離開或請不要再使用本軟體。
InstallShield
< Back
Next >
Cancel


HY3131EVA_V1.10 - InstallShield Wizard
Customer Information
Please enter your information.
User Name:
Yenhon
Organization:
HYCON
Install this application for:
Anyone who uses this computer (all users)
Only for me (Yenhon)
InstallShield
< Back
Next >
Cancel



Select installation path





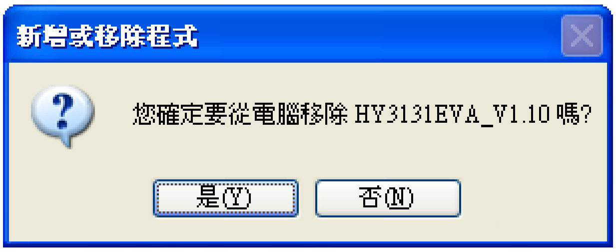
2. Software Removal

To certain operation systems, it requires Administrator identity to remove software.

- Control panel（Start → setup → control panel）, clicking "install/remove program".



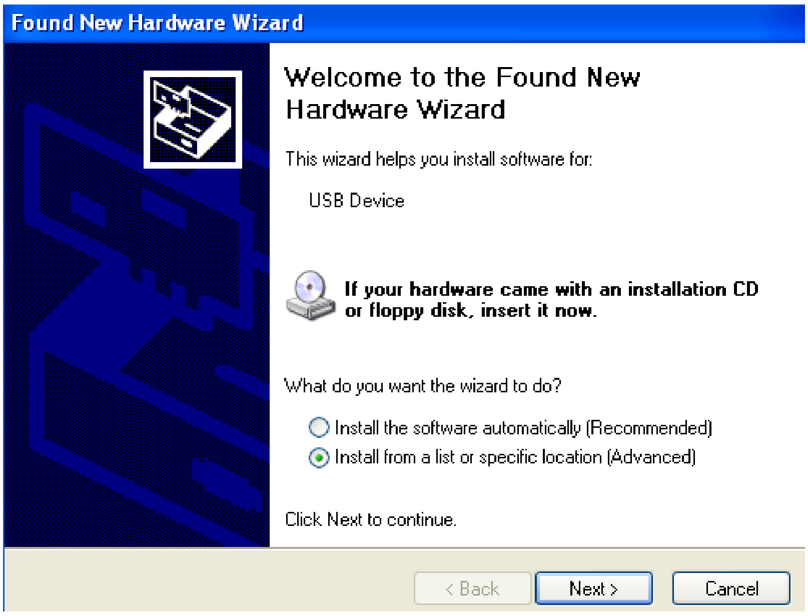
- After pressing "Yes", the program will be removed but no relative window will pop up.



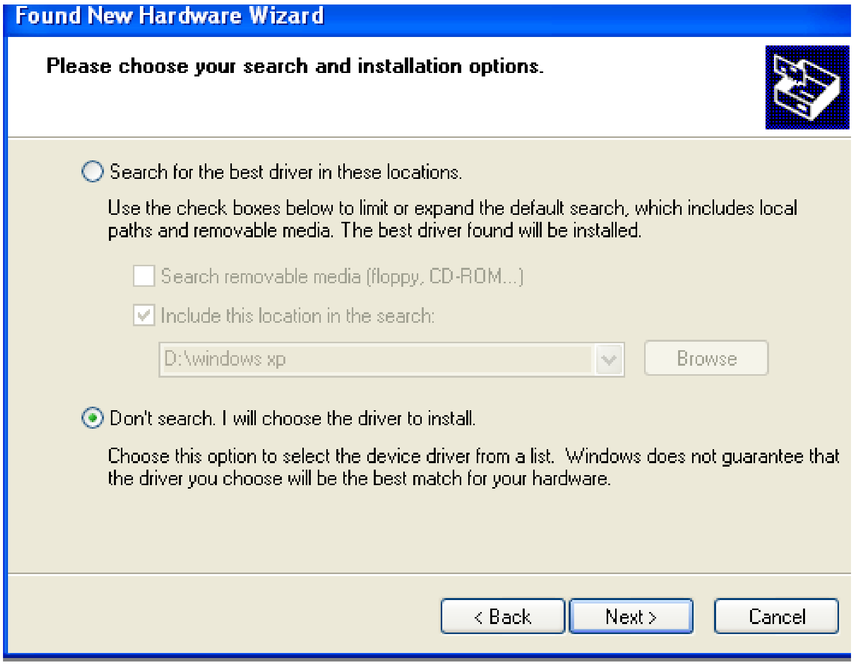
3. Software Installation

For certain operation systems, it requires Administrator identity to install hardware driving program.

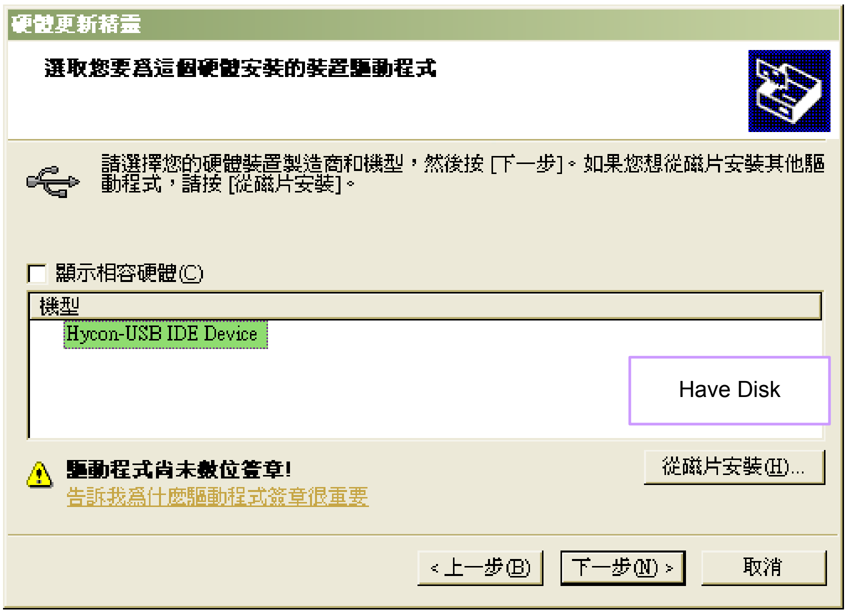
- When connecting PC and USB ENOB Test Board via USB wire, PC will find a new hardware. Please select "Install from a list or specific location (Advance)" and proceeds next step.



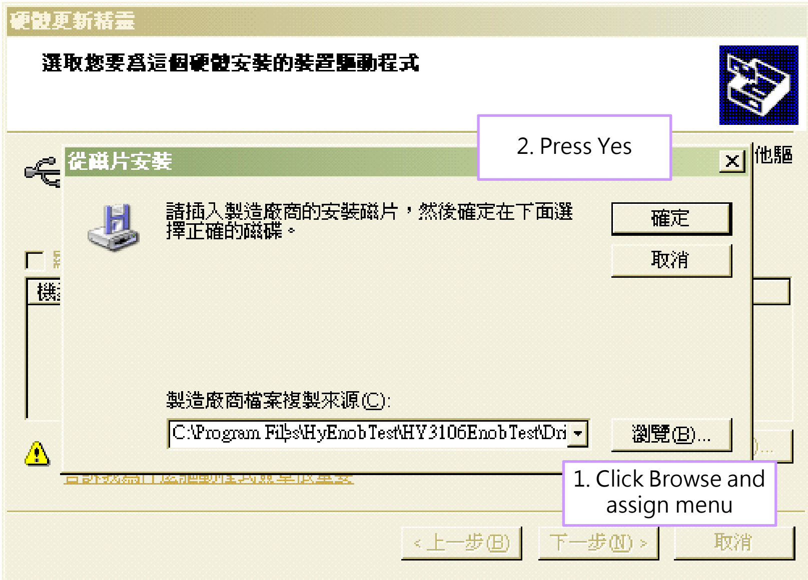
- Select "Don't search. I will choose the driver to install" and press next.



- Click "Have Disk".



- Click browse and assign driving program menu, the default location is "C:\Program Files\HYDMM\HY3131\Driver\" and press yes.



- Select "Hycon-USB Temperature Reader Device" and press next. After compatibility warning shows up, please press "continue installation".



- Install complete



3. Software Menu Description

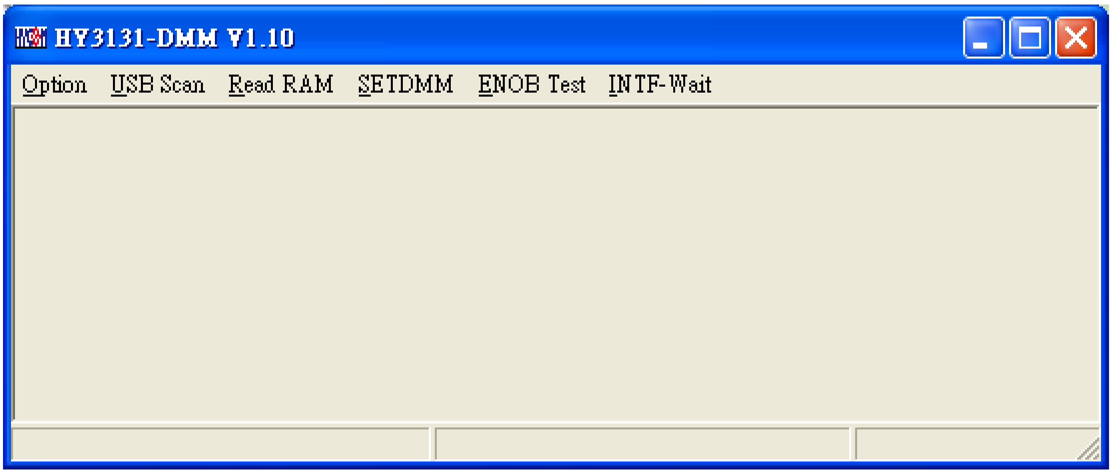


Figure 3-1

OPTION: Setup and graphical block diagram
USB Scan: USB controller scan
Read RAM: Reload registers status
SETDMM: Load and calibration setup of DMM ranges
ENOB Test: RMS noise and noise free test
INTF-Wait/INTF-reading: When ADC under read status, it must be configured in INTF-reading status. ADC will reload data after INTF flag event occurs.

3.1 Option

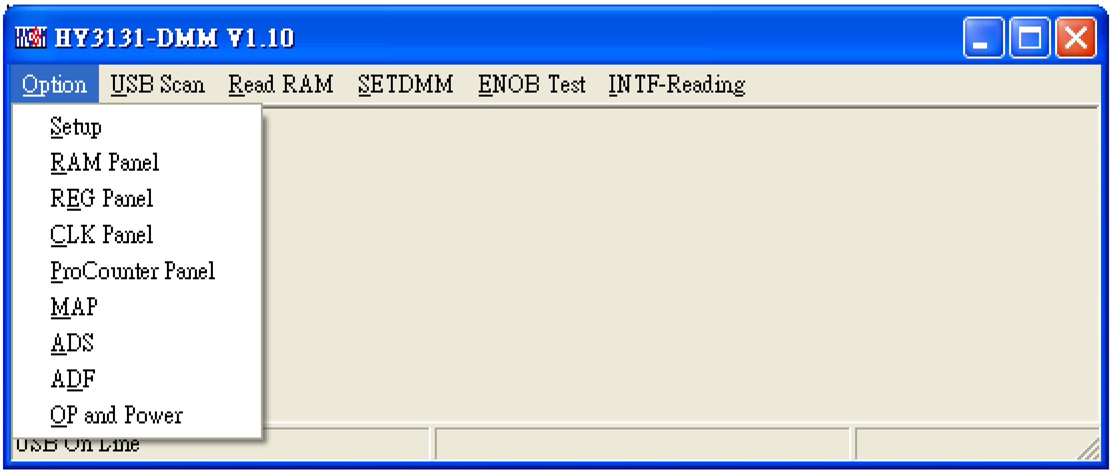


Figure 3-2

Introduce in sequence:

3.1.1 Setup

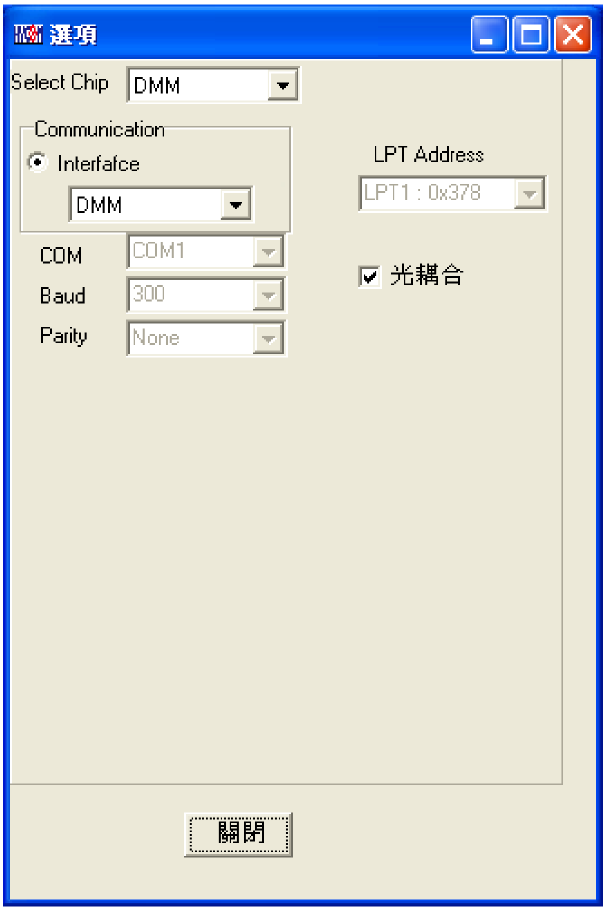


Figure 3-3

When test tool and HY313X series are connected, the device number and communication mode is set. User needs not to make other selection.

3.1.2 RAM Panel

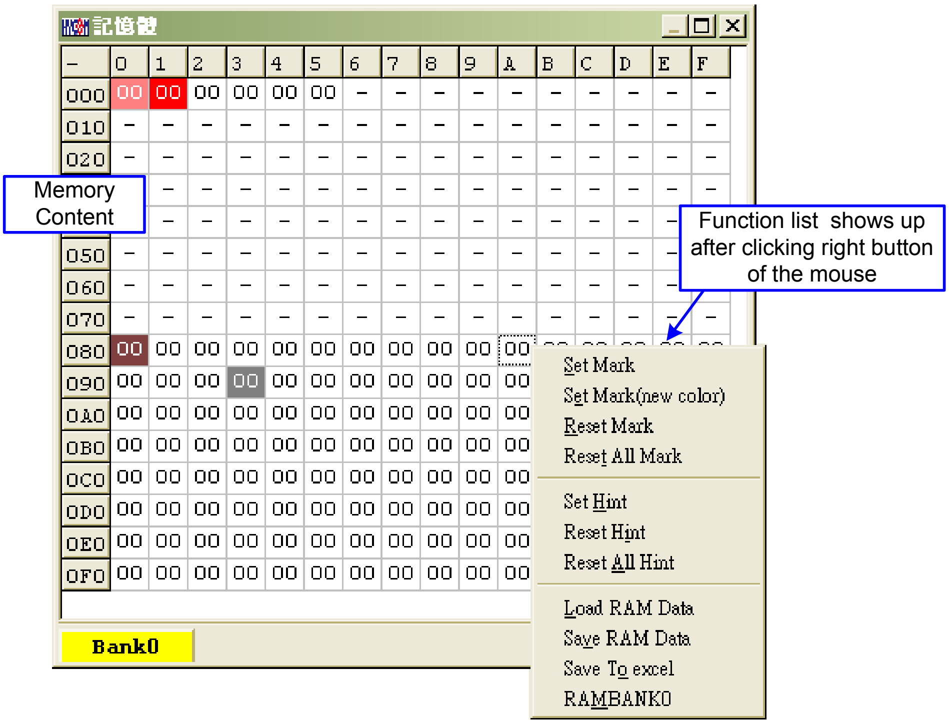
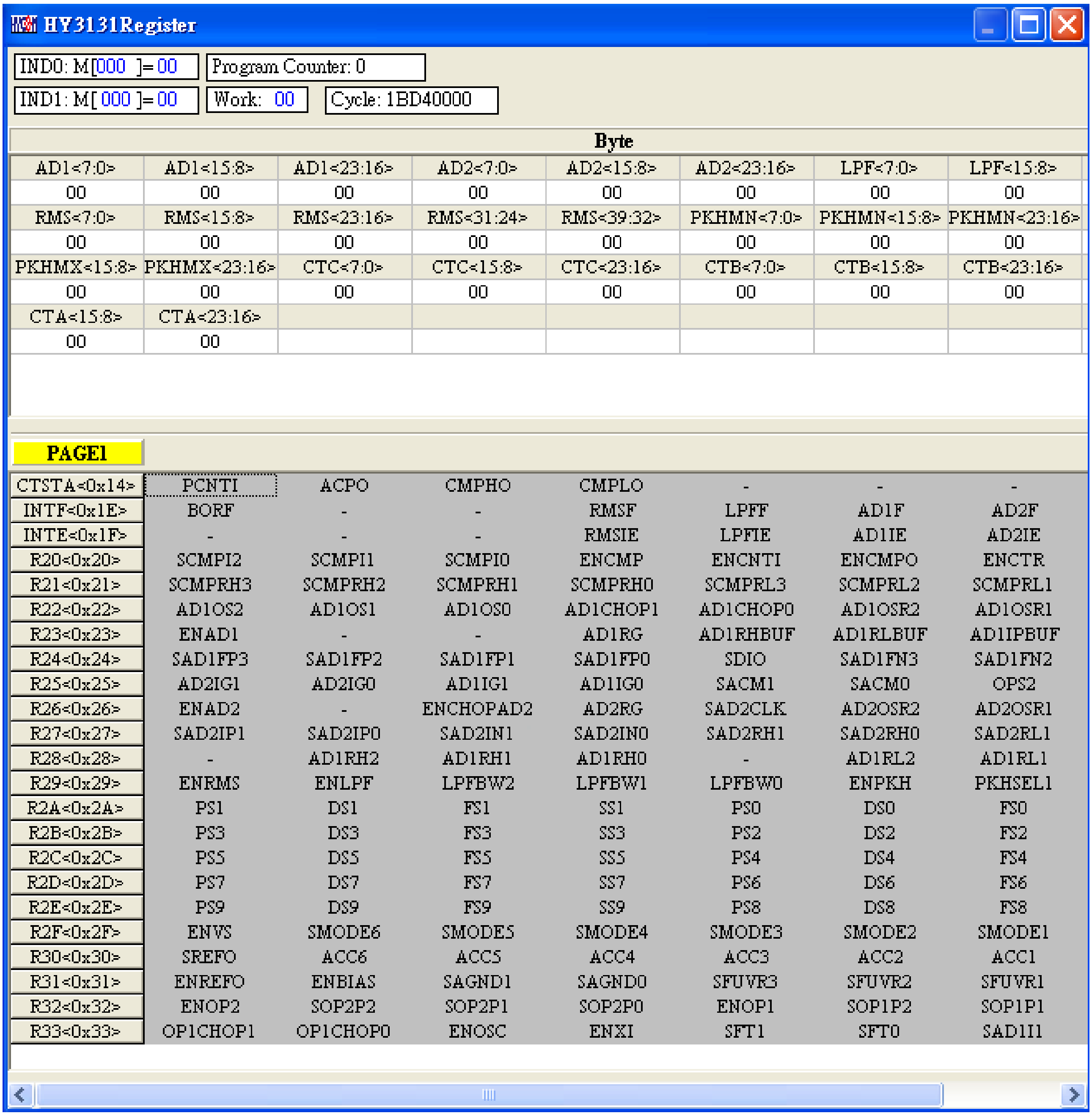


Figure 3-4

- Open RAM window, memory content of the chip will be displayed.
- If the address is inexistent, it will display —.
- If the address underlined number, it means Hint has been configured.
- The data in the address can be directly amended by clicking the left button on the address.
- By double-clicking the left button on the address, the window of amending data will show up.
- For detailed operation description, please refer to Chapter 3.2 of HY-IDE software user manual.

3.1.3 REG Panel



Byte							
AD1<7:0>	AD1<15:8>	AD1<23:16>	AD2<7:0>	AD2<15:8>	AD2<23:16>	LPF<7:0>	LPF<15:8>
00	00	00	00	00	00	00	00
RMS<7:0>	RMS<15:8>	RMS<23:16>	RMS<31:24>	RMS<39:32>	PKHMN<7:0>	PKHMN<15:8>	PKHMN<23:16>
00	00	00	00	00	00	00	00
PKHMX<15:8>	PKHMX<23:16>	CTC<7:0>	CTC<15:8>	CTC<23:16>	CTB<7:0>	CTB<15:8>	CTB<23:16>
00	00	00	00	00	00	00	00
CTA<15:8>	CTA<23:16>						
00	00						

PAGE1							
CTSTA<0x14>	PCNTI	ACPO	CMPHO	CMPLO	-	-	-
INTF<0x1E>	BORF	-	-	RMSF	LPFF	AD1F	AD2F
INTE<0x1F>	-	-	-	RMSIE	LPFIE	AD1IE	AD2IE
R20<0x20>	SCMPI2	SCMPI1	SCMPI0	ENCMP	ENCNTI	ENCMPO	ENCTR
R21<0x21>	SCMPRH3	SCMPRH2	SCMPRH1	SCMPRH0	SCMPRL3	SCMPRL2	SCMPRL1
R22<0x22>	AD1OS2	AD1OS1	AD1OS0	AD1CHOP1	AD1CHOP0	AD1OSR2	AD1OSR1
R23<0x23>	ENAD1	-	-	AD1RG	AD1RHBUF	AD1RLBUF	AD1IPBUF
R24<0x24>	SAD1FP3	SAD1FP2	SAD1FP1	SAD1FP0	SDIO	SAD1FN3	SAD1FN2
R25<0x25>	AD2IG1	AD2IG0	AD1IG1	AD1IG0	SACM1	SACM0	OPS2
R26<0x26>	ENAD2	-	ENCHOPAD2	AD2RG	SAD2CLK	AD2OSR2	AD2OSR1
R27<0x27>	SAD2IP1	SAD2IP0	SAD2IN1	SAD2IN0	SAD2RH1	SAD2RH0	SAD2RL1
R28<0x28>	-	AD1RH2	AD1RH1	AD1RH0	-	AD1RL2	AD1RL1
R29<0x29>	ENRMS	ENLPF	LPFBW2	LPFBW1	LPFBW0	ENPKH	PKHSEL1
R2A<0x2A>	PS1	DS1	FS1	SS1	PS0	DS0	FS0
R2B<0x2B>	PS3	DS3	FS3	SS3	PS2	DS2	FS2
R2C<0x2C>	PS5	DS5	FS5	SS5	PS4	DS4	FS4
R2D<0x2D>	PS7	DS7	FS7	SS7	PS6	DS6	FS6
R2E<0x2E>	PS9	DS9	FS9	SS9	PS8	DS8	FS8
R2F<0x2F>	ENVS	SMODE6	SMODE5	SMODE4	SMODE3	SMODE2	SMODE1
R30<0x30>	SREFO	ACC6	ACC5	ACC4	ACC3	ACC2	ACC1
R31<0x31>	ENREFO	ENBIAS	SAGND1	SAGND0	SFUVR3	SFUVR2	SFUVR1
R32<0x32>	ENOP2	SOP2P2	SOP2P1	SOP2P0	ENOP1	SOP1P2	SOP1P1
R33<0x33>	OP1CHOP1	OP1CHOP0	ENOSC	ENXI	SFT1	SFT0	SAD1I1

Figure 3-5

Please refer to Chapter 3.3 Register window operation of HY-IDE software user manual.

3.1.4 CLK、ProCounter、MAP、ADS、ADF、OP and POWER Panel

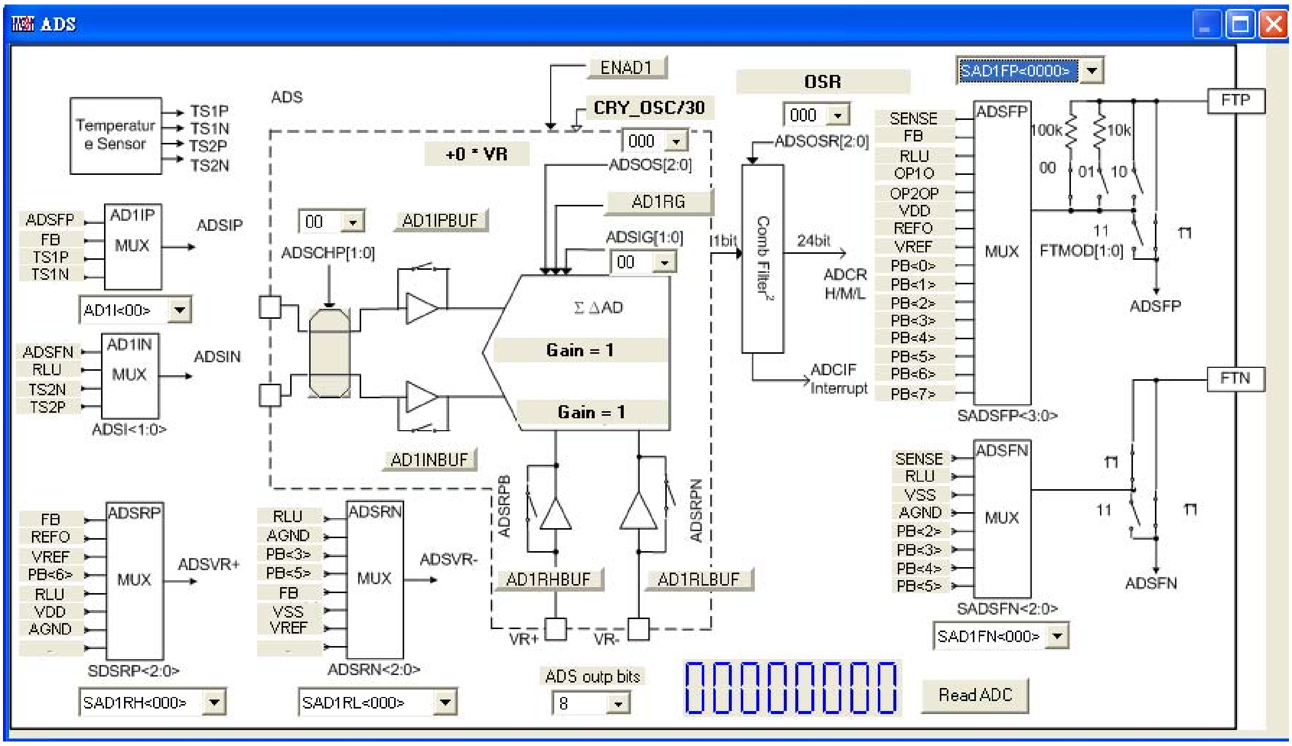


Figure 3-6

- Every Panel will display relative configuration parameters, please refer to HY3131datasheet.
- ADC will update data when READ ADC and "INTF-READING" displayed.
- ADS ADC output is 24bit, after setup via ADS output bits, desirable bits will display on the window.

3.2 USB Scan

When USB port is connected to ENOB control board, "USD On Line" will display as like the following figure:

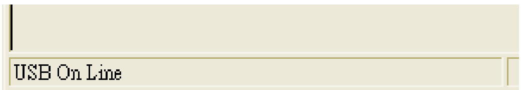


Figure 3-7

3.3 Read RAM

After "USB Scan" completed and "USB on Line" was confirmed, please implement Read RAM. The RAM and Registers of chip will be read to the buffer zone of PC. It will affect RMS Noise and Peak-to-Peak Noise operation of ENOB Test.

4 ENOB Test

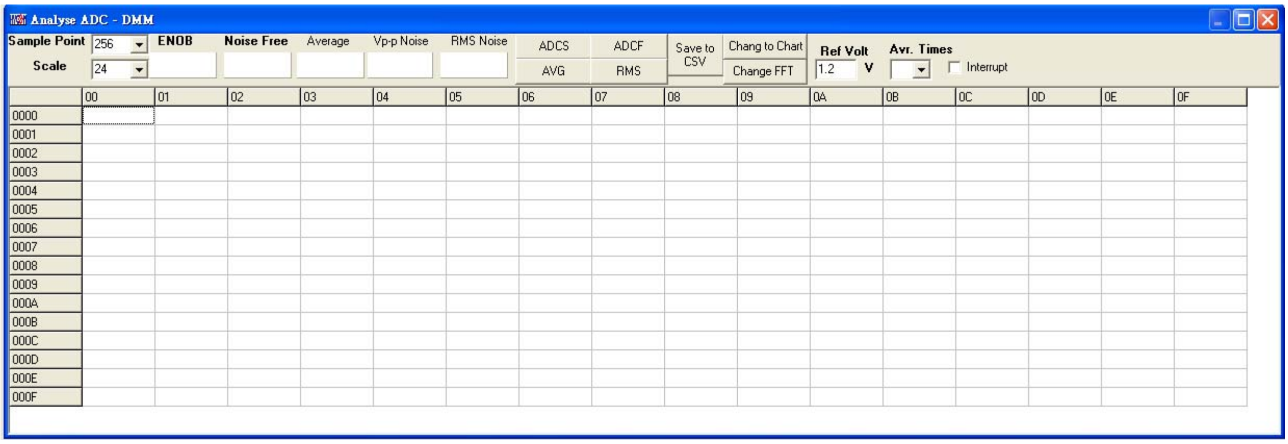


Figure 3-8

1. **Sample Point**

   ADC sample point of "Catch ADC" and "ADC-Temp" function. Minimum sample of OTP ADC output is 256 record and maximum is 65536 records.

2. **Scale**

   ADC output bit. Minimum ADC output bit is 8-bit and maximum is 24-bit.

3. **ENOB**

   Display ENOB, the calculation is shown as Equation 3, the unit is bit.

4. **Noise Free**

   Display Noise Free Bits, as Equation 4, the unit is Bit.

5. **Average**

   Display sampling average value of ADC, as Equation 1, the unit is Counts.

6. **Vp-p Noise**

   Display Peak-to-Peak Noise, as Equation 5，the unit is nV.

7. **RMS Noise**

   Display RMS Noise, as Equation 2, the unit is nV.

8. **ADCS、ADCF、AVG、RMS**

   Real time capture and sequence display ADC value in value display zone.

9. **Save to CSV**

   Save the display value to *.CSV file, including ENOB, Noise Free, Average, Vp-p Noise and RMS Noise.

10. **Change To Chart**

    Switch chart and value in value display zone.

11. **Ref Volt**

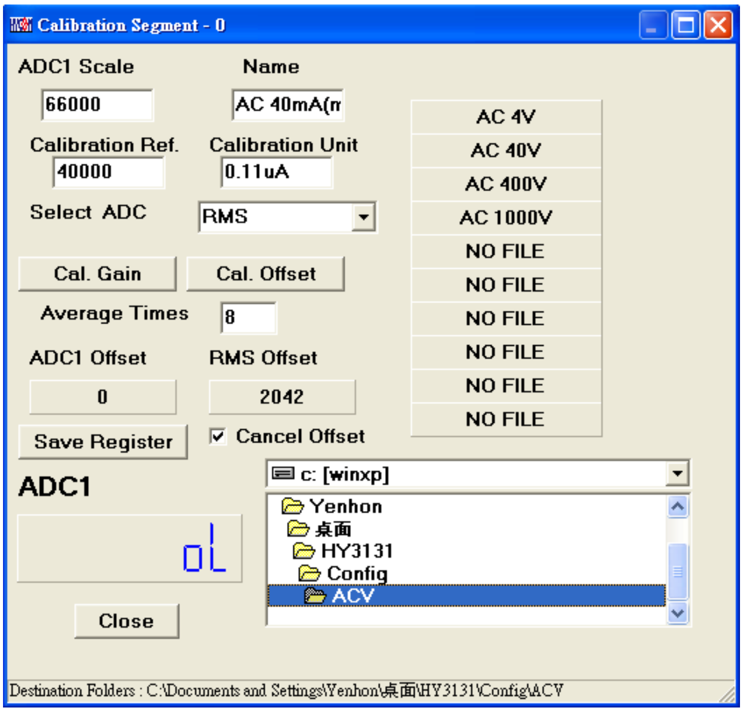
Input Reference Voltage (unit: V).

12. Avr. Times

Select software average, the value is display zone will perform average again, according to the times of selection and then display in value display zone.

5 SETDMM

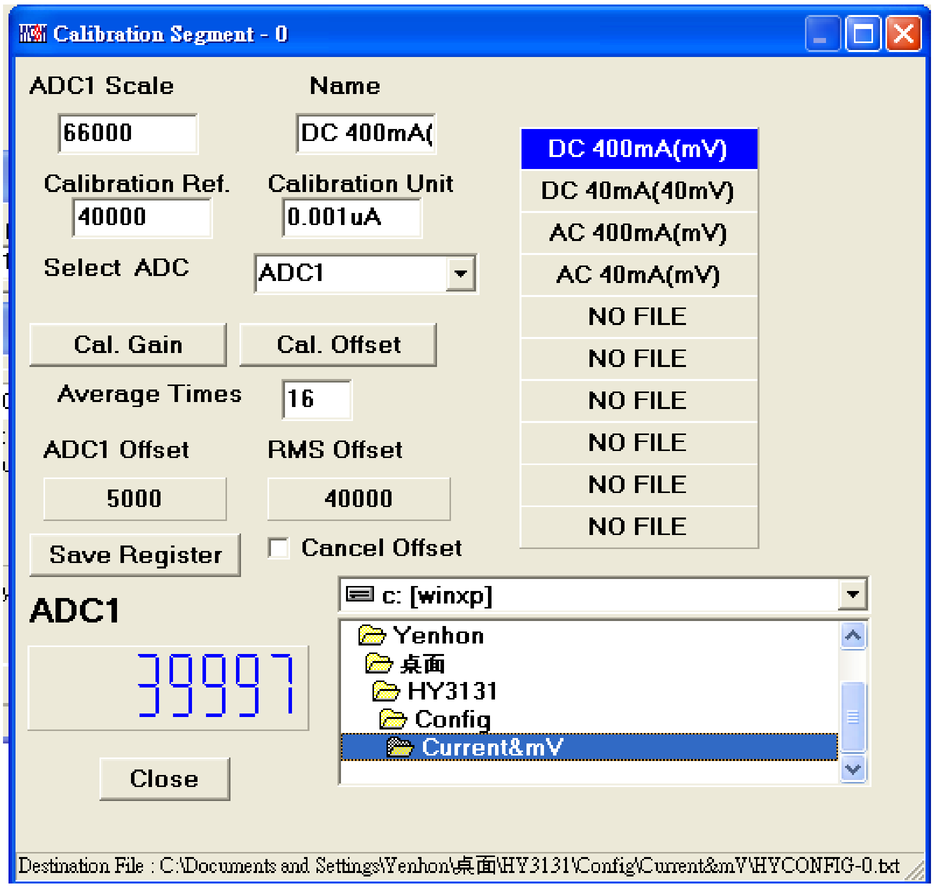
User can store register setup file through SETDMM dialog and test every range's efficiency under calibration status.



First, configure the path to install menu. HYCON offers different range configuration.



Take DC 400mV as an example:



After click, it will be highlighted and displayed in blue color.

To enhance identification, NAME and calibration unit can be marked by users in word form

ADC1 scale: Maximum value after calibration.

Calibration Ref: ADC output will be calibrated as ref. value.

Select ADC: select ADC1 or RMS output as output

Cal. Gain: ADC data of the current network status will be configured as “Calibration Ref” setup after pressing this button.

Cal. Offset: Record the current ADC1 or RMS output value as offset. When ”cancel offset” is ticked, ADC1 will deduct offset value and multiply calibration GAIN; RMS will deduct offset first, then perform root and multiply GAIN of RMS.

Save Register: Save all registers status in the setup file that is highlighted in blue color. If NO FILE is selected and then save is pressed, one setup file will be added in this menu; however, maximum setup file within a menu is ten.

Configure Jump on HY3131 Target Board based on different measurement functions:

Function	J2	J6	J17	J8
ACV DCV	Short	Open	Open	Open
AC mV DC mV Thermocouple	Open	Short	Open	Open
AC Current DC Current	Open	Open	Open	A(Open) mA(1-2) uA(2-3)
Resistor Continuity Diode Capacitor	Open	Short	Open	Open
Frequency(CNT Input)	Open	Short	Short	Open

6 Hardware Description

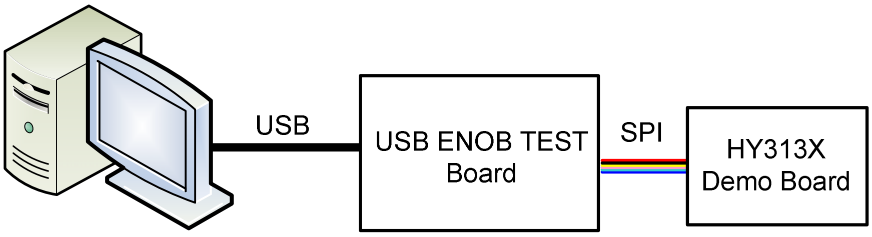


Figure 5-1

PC transmits Command to USB ENOB Test Board; USB ENOB Test Board configures and reads ADC value via SPI from Hycon HY310x Demo Board.

6.1 USB ENOB Test Board Description

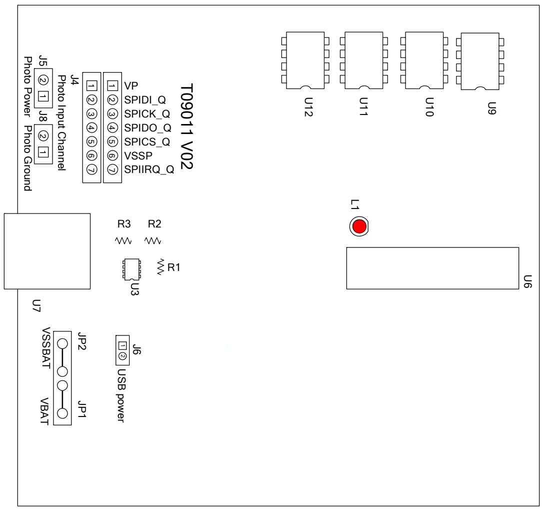


Figure 5-2

1. J4：Optical Coupler SPI Port

J4 description

PIN 1 → VP, powered by optical coupler IC (U8~U13), J5 and J8 must be opened to completely isolate power. J5 and J8 must be short to use common power supply.

PIN 2 → SPIDI_Q, optical coupler DI signal wire.

PIN 3 → SPICK_Q, optical coupler CK signal wire.

PIN 4 → SPIDO_Q, optical coupler DO signal wire.

PIN 5 → SPICS_Q, optical coupler CS signal wire.

PIN 6 → VSSP, optical coupler Ground.

2. JP1, JP2, J6, U3：Power Supply Circuit

JP1 and JP2 is external power input that supply power to U3 and generates VDD power. Using USB power, J6 is short circuit. Using external 5V power, JP1 and JP2 inputs, J6 is open circuit. Regulated circuit that composed by U3, R1, R2 and R3 generates VDD power. Amending R1, R2 and R3 can change output voltage, the relation is as follows:

$$VDD = 1.240V \times \left(1 + \frac{R1 + R2}{R3}\right) \qquad (6)$$

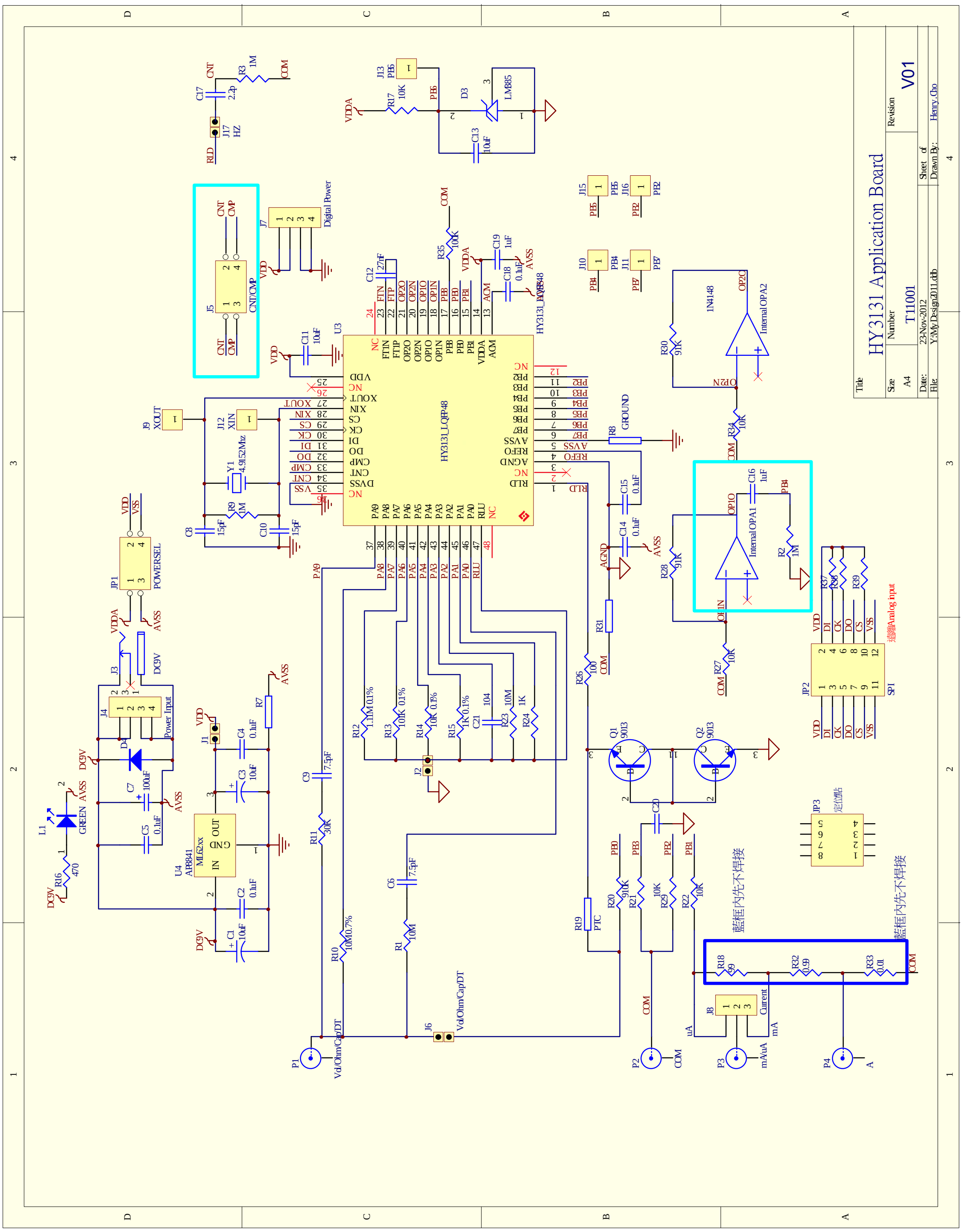
3. U9, U10, U11, U12：

Optical coupler IC components

4. U7：USB Port

Port connecting to PC, is the power source of entire system (5V), 500mA input.

6.2 HY313x Demo Board Description



7 Question Obviation

1. **Registers cannot be configured under ADC window?**

   Communication way and IC selection must be configured first. After executing USB Scan and Read RAM, ADC register value can be configured. If USB is connected and confirmed, configuration still cannot be implemented, please close program and remove USB. After plug in the USB, execute the program again.

2. **Configuration of ADC window is relatively slow?**

   Please do not change any setup when ADC reads data, this might bring about unpredictable results.

3. **Can the data obtained include time?**

   Data obtained from the program includes file that be saved as CSV format but not including time. Users can detect the X axis represents time in graphical display mode, demonstrating in ms. Time recording function will be incorporated in next version of program update.

4. **Program cannot be executed, file lack appears and program demands to reinstall.**

   Please print the error window and message and please contact the distributor who provided this DMM EVA Test Tool to you or directly contact HYCON Technology for further support. We are sorry for the inconvenience this has caused to you.

5. **INF error shows up when USB drive program is under installation or is completed and a yellow exclamation mark appears in “device manager”.**

   Please copy all programs of Driver file in the installation menu to ｃ:\windows\system32\drivers. Reinstall driving program again. If error shows up again, please contact the distributor who provided this DMM EVA Test Tool to you or directly contact HYCON Technology for further support.

8 Revision Record

Major differences are stated thereinafter:

Version	Page	Revision Summary
V01	ALL	First edition
V02	20	Add in the Table of Target Board Jump of different measurement functions.
	22	Add in circuit diagram